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ABSTRACT

This booklet provides the basic information for starting an energy conservation program. Guidelines for involving all school personnel and promoting energy conservation throughout the entire Canadian education system are provided. Outlined in the booklet are methods for climate proofing the building envelope and making the system air tight, conserving energy in administrative offices and public areas, effective use of heating, ventilation, and air conditioning systems, and management of lighting systems. Ways to conserve energy in the cafeterias and kitchen areas comprises a large segment of the manual. Ways to conserve energy on school grounds through management of lighting systems and conserving fuel through maximizing use of vehicles are detailed. The concluding section provides an outline for setting up and running an effective energy management program. (SM)

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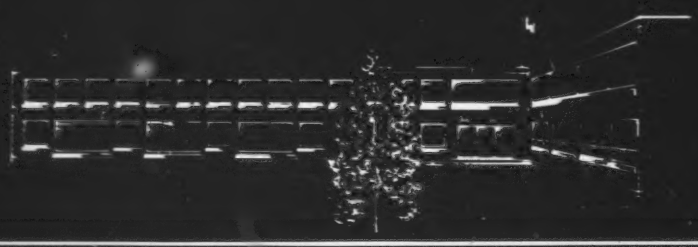

ENERGY MANAGEMENT IN SCHOOLS

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E N E R G Y M A N A G E M E N T I N S C H O O L S

Canadian School Trustees' Association

Education Task Force on Energy Management
Energy, Mines and Resources Canada
Ottawa, Ontario

[R86/1450R]

CANADIAN SCHOOL TRUSTEES' ASSOCIATION
L'ASSOCIATION CANADIENNE DES SYNDICS DES ECOLES
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Energy Management for Schools is designed to assist everyone involved in primary and secondary education to improve the management of energy in Canadian schools and to enhance their dedication to the conservation of energy and natural resources.

This booklet has been updated, especially in the section concerned with lighting and other power requirements. It also includes energy saving techniques developed for the Canadian Hospitality Industry Energy Management Task Force and for the Ontario School Trustees' Council.

The research and compilation of the checklists have been done by the staff of Energy, Mines and Resources, Canada to whom the Canadian School Trustees' Association expresses its gratitude and thanks.

ISBN # 0-920632-25-4

YOU ARE NOT ALONE

This booklet provides the basic information for the start of an energy conservation program. Should you want more information about energy management, you should contact Energy, Mines and Resources at the addresses shown below. The Conservation and Renewable Energy Offices (CREOs) can also be of assistance in arranging for the presentation of energy management seminars, and can help in the organization of an energy management task force for your region.

[R86/1450R]

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INVOLVEMENT

Programs on energy conservation will not reach their potential unless there is effective co-operation and understanding from those within the buildings of the school system: teaching staff, non-teaching staff, students and the school board itself.

Persistence will be essential for co-operation and understanding. Canadians have been wasteful with energy for years, the old habits are hard to change. Further, Canadians continue to believe they have an abundance of energy. Only through persistence will recognition come that we are vulnerable to energy shortages.

INVOLVEMENT

1. Conduct a seminar for all building maintenance people on energy conservation policies and needs prior to the opening of the school. It would be advisable to hold follow-up seminars to report specific progress prior to the end of the school year.

2. If it has not been done already, establish a base year against which it will be possible to compare future records of energy consumption. A school board could consider a financial incentive, in the form of a rebate, for the cost of energy saved over a pre-determined period of time.

3. Post reminders and other promotion pieces concerning energy conservation on all bulletin boards in school. Photographs illustrating energy waste can also be used to good effect. A school board might consider an intensive campaign at te beginning of the school year for a student awareness campaign.

4. Conduct an energy management awareness camapign in every classroom. The awareness campaign would allow a classroom to use initiative in promoting and practicing energy management awareness and provide the opportunity for a contest with suitable prizes.

5. Stickers reminding people to turn off lights when not needed could be placed on or near all light switches, encouraging people to become involved in energy management.

6. Consider an energy awareness essay competition for all classrooms in every grade. Such a contest would involve students in energy management, especially if they see their idea being utilized.

7. A school board could ensure that promotion materials provided by Energy, Mines and Resources, Canada, are available to all schools in their system. It could also get help from EMR in organizing energy management seminars.

8. School Board Building Committees should hold intensive seminars for school maintenance staff using specialists on energy management. (EMR's Energy Management & Technology Transfer Program is specifically designed to present such seminars). School Board members should participate in such seminars.

9. School boards could consider an incentive program aimed at their principals using comparative consumption records of oil, gas and electricity. The Board could provide an incentive fund for the activities of a principal's school based on energy management and dollars saved.

[R86/1450R]

10. School boards could adopt a resolution for inclusion in administrative manuals. Its objective would be to instill in the minds of staff the fact that we live in a finite world, that energy management is essential for today's and tommorrow's generations. The resultion would be circulated to principals, teachers and administration.

11. Trustees, teachers and other staff should demonstrate their own commitment to energy management and set a good example for students.

12. The school board could establish short term goals in energy management and demand frequent progress reports.

13. All programs undertaken by a school board for energy management should be widely publicized in the community to encourage others to give leadership in energy management.

14. All promotion and recommendations concerning energy management should seek to develop a team spirit.

15. Students, teachers and principals should be encouraged to report malfunctioning equipment in the schools.

16. A school board could encourage principals to exchange ideas and suggestions for changes in the schools that will facilitate energy management. It is suggested that a good month to do so would be October.

17. School boards could consider an energy management clause in negotiated agreements, committing employees to co-operate with energy management programs.

Energy management is essentially the recognition that we must conserve energy followed by a dedicated effort to do so. Persistent, simple, people-involving programs and promotions have been shown by school boards across Canada to be effective. Costly programs are not needed for energy management as much as people involvment; encouragement and recognition stimulates people involvement.

[R86/1450R]

THE BUILDING ENVELOPE

A considerable volume of information is available as to the ideas, building materials, engineering, architecture, etc., involved in putting up or modifying a building. This is the realm of the professional.

However, there are many other simple matters that can be checked by school personnel that can assist energy management once the building is in use.

THE BUILDING ENVELOPE

1. Maintain a constant check of all windows for breaks or cracks.

2. See if it is possible to close off any skylights in a school building at times when they cause excessive heat loss or gain.

3. Check the caulking of the following areas annually (before winter): windows; gaps underneath baseboards; around wall receptacles; opening where plumbing and wiring enter buildings; any cracks on inside surfaces of walls and ceilings; and inside corners and gaps where walls and ceilings meet.

4. Before winter, weatherstrip all outside access doors, (paying special attention to the threshold) and all operable windows.

5. Ensure the insulation in school buildings is checked annually, and replace it where necessary.

6. Check all door closers to ensure that they are closing quickly and completely.

7. Install automatic door closers on all exterior doors.

8. Install vestibules where possible at all major entrances and exists.

9. Consider a solar or reflective film installation on existing large windows.

10. Install awnings on west windows.

11. Plant deciduous trees by west windows to offer shade in summer. Erect earth berms to help buffer the prevailing wind.

12. A school board could consider using canopies, projecting mullions, louvres, shaded or coloured glass in windows to improve the efficiency of cooling or air conditioning systems.

[R86/1450R]

OFFICE AND PUBLIC AREAS

Energy management is a matter of control and perseverance, especially in places where there are numbers of people working or where there is a lot of traffic. Office and public areas are often overlooked in energy management, but they represent a considerable source of energy mismanagement if simple actions are not taken regularly. The following are some suggestions that could help in preventing energy mismanagement in office and public areas.

OFFICE AND PUBLIC AREAS

1. A school board could consider naming a specific person or team who would be responsible for environmental conditioning, lighting and sound systems in office and public areas. A schedule could be set up for turning heat and lights on and off. It takes only an hour to an hour and a half to heat such rooms.

2. Arrange for cleaning during daylight hours to utilize natural lighting where possible.

3. Establish a regular schedule for washing walls and ceilings, and for dusting lightbulbs and fixtures. Dirt can be a factor in energy mismanagement.

4. When redecorating, choose light colours which will reflect light rather than dark colours which absorb it.

5. Install solar film to reduce heat transference through large windows. An alternative is to install awnings to prevent direct sunlight entering room.

6. Keep cutains and shades closed in unoccupied room.

7. If the school is of an age that storm windows are still being used, energy management will be enhanced if they are kept clean and left on year round.

8. If necessary, have separate switches installed so lights in unused sections of rooms can be turned off or down.

9. In rooms with high ceilings, it would be advisable to investigate some way of lowering lighting fixtures to bring light closer to the areas needing illumination.

10. Install solid-state dimmer switches whenever possible. Dimmers save energy, make bulbs last longer and allow you to control the lighting mood.

11. Reduce lighting in lobby, lounge areas and hallways during daylight and late night hours

12. Consult the Lighting Section for information about permanently reducing lighting load in hallways and other areas.

13. In a school that is not fully occupied, devise a room plan showing the order in which rooms should be assigned, so that only a few rooms are being well used. Because heat rises, you should always fill your lower floors first, if feasible.

14. Consider closing entire wings or floor when the school is not fully occupied.

[R86/1450R]

15. Rearrange work areas if necessary so office staff working in slack times use the same area. You can then avoid lighting and heating or cooling several areas for limited staff.

16. Reduce hot water temperature in public washrooms, and install flow restrictors and self-closing faucets.

17. Reduce peak electric demand by staggering the times individual heating, ventilating, and cooling units are started.

18. Turn off lights when not in use and during daylight hours.

19. Keep windows and outside doors closed when heating or air conditioning equipment is on.

20. During the air conditioning season use heat-producing office equipment such as photocopiers early in the day if possible.

21. Fix or report any electrical or plumbing deficiencies such as leaking taps as soon as they are observed.

22. Remove obstructions that restrict free flow of air through heating and cooling units. Furniture placed within a foot of the air inlets of units, and books or magazines placed on top waste energy by making them operate longer than necessary.

23. If something's not being used, turn it off.

24. Establish a three month schedule for cleaning and replacing filters in heating and cooling units.

25. Clean heating, cooling and condenser coils regularly.

26. Check the condition of wall sockets, particularly those used for heavy loads. Replace as required.

The preceding are quite simple matters and a school board could think of establishing a daily or weekly checklist to assure that simple activities that will enhance energy management are being carried out.

In addition, very serious conservation should be given to installing micro-processors to control lighting, heating, ventilation and air conditioning.

[R86/1450R]

H V A C

HEATING . VENTILATION . AIR CONDITIONING

In energy management it is vital to pay close attention to heating, ventilation and air conditioning. The following areas will be dealt with in this section: general, central heating/air conditioning systems, central boiler plants and domestic water systems.

HEATING/VENTILATION/AIR CONDITIONING

General

1. School boards should urge staff to report over-heated or over-cooled rooms rather than opening windows. Further, they should urge staff to avoid placing furniture or any other obstruction in front of heating or cooling vents.

2. Consideration could be given to installing separate controls for heating or cooling vestibules or entrances. They don't have to be at the same comfort level as interior rooms.

3. Consideration could also be given to installing heat deflectors over vents to help air circulate better.

4. School boards could consider supplementary heating in rooms where heating requirements cause other rooms to be overheated.

5. If compressors are used in your system it is important to ensure that they are not located near heating units.

Central Heating/Air Conditioning/Air Change Systems

1. Investigate whether or not you can reduce the volume of fresh air intake, based on ASHRAE Standard 62-73 (American Society of Heating Refrigeration and Air Conditioning Engineers).

2. Raise the temperature of water leaving the chiller as the air conditioning load is reduced.

3. Set electrical demand limits on chillers (60% max).

4. Shut down the condensor water pump and chilled water pump when a chiller is out of service.

5. Consider setting the chilled water leaving temperature to 14 degrees Celsius as a minimum.

6. Shut off the pre-heat coil in multi-zone units during the cooling seasons.

7. Consider installing a system that can shut down chillers and air handling systems at night.

8. During the summer months, condition only those areas where specific tasks are being performed (i.e. offices and administration areas).

9. Whenever possible, use outdoor air for cooling.

10. Reduce unit ventilator capacities, and, if possible, include them in your micro-processor program.

11. Keep laboratory and ventilating exhaust hoods closed when not in use.

12. Consider using water treatment systems to improve heat transfer characteristics.

13. Use filters with low friction losses.

14. Limit the use of humidity control to specific areas of need.

15. Use time clock or micro-processor controlled systems for the shut-down during the off-hours of ventilation and exhaust systems.

16. With air heating systems, close the fresh air dampers during the off-hours, and centrally control the night setback of temperature.

17. Precool buildings to three degrees Celsius below outside temperature, or 27 degrees Celsius (whichever is greater when occupancy begins), and complete the cooling during the first hour of occupancy.

18. At night, flush the building with cooler outside air to reduce air conditioning requirements.

[R86/1450R]

19. Use thermostat feedlock controls in the return air ducts to control temperature.

20. Check that mechanical cooling is not being used when a building is unoccupied.

21. Have a policy that air conditioning is to be shut down from, say September 15 to May 1, depending on your location in Canada.

22. Consider maintaining room temperature as follows: classrooms and offices, 20 degrees Celsius; storage and unused areas, 14 degrees Celsius.

23. Arrange for thermostats to be set at 14 degrees Celsius at the end of the day, for classrooms and offices, at 10 degrees for storage and unused areas. This can be done manually or by programming a micro-processor controller.

24. Set cooling temperatures to a minimum of 26 degrees Celsius.

25. Establish and adhere to a maintenance schedule to recalibrate thermostats regularly.

26. Clean or change all filters according to manufacturer's directions.

27. Clean and straighten fins of condensing coils on both the interior and exterior sides.

28. Check fan blades for alignment and cleanliness. Oil all fans monthly. Squirrel cage fans should be removed for proper cleaning.

29. Check all drains in self-contained units. If the drain for the condensate from the coil becomes clogged, proper drainage cannot take place.

30. Check refrigerant system for gas charge.

Boiler Plants

1. During heating season, if one boiler will carry the load, shut down other boilers. One boiler operating at 80 per cent capacity is 7% more efficient than two operating at 40 per cent capacity.

2. Set pressure on steam boilers as low as possible to achieve required output.

3. Excessive boiler blowdown drains hot water needlessly. Establish a blowdown schedule and follow it.

4. Steam condensate should be returned to the feed water tank for reuse.

5. Install a thermometer in the flue outlet and maintain stack temperature according to manufacturer's directions.

6. Check chimney frequently for visible smoke which indicates inefficient combustion.

7. Check fuel oil pumps regularly to maintain correct oil pressure and flow to burners.

8. Inspect and clean strainers on hot water, steam and condensate lines.

9. Inspect boilers regularly and remove deposits of soot, scale or slag by scraping, brushing or vacuuming.

10. Inspect combustion chamber refractory for deterioration, cracks and leaks and repair as required.

11. Check steam traps for leakage and repair or replace as required.

12. Check packing glands, valves and joints for leaks, repair as necessary.

13. Check condensate tank vents for a visible plume of steam which indicates blowing steam traps that should be repaired.

14. Check operation of pressure reducing and regulating valves, and adjust, repair or replace as necessary.

15. Check gas burners and set for correct gas flow. Remove mineral or corrosion build-up on burners and burner parts.

16. Seal any casing leaks.

17. Check belts for wear and tension, replace when necessary.

18. Clean all tubes and connections of fan-coil units.

[R86/1450R]

19. Lubricate motors and compressors following manufacturer's recommendations.

20. Lubricate motor bearings. Check for excessive noise or vibration. Replace worn bearings.

21. Check controls and adjust if necessary to prevent short cycling or continuous compressor operation.

22. Check all dampers and linkage for proper operation, ensuring there is no leakage when in closed position.

23. Keep all screens on inlet ducts clean and free of debris.

24. Keep outdoor portions of cooling systems clear of plants, vines and other obstructions to air flow. Eliminate any condition that would cause warm air to circulate back into the air conditioner.

25. Clean and check all ductwork for systems for air leakage and for damaged insulation. Repair as required.

26. Check canvas for flexible duct connections at fan/blower air handling units. Replace as required.

27. Check and, as necessary, replace insulation on all pipes and vents where thermal control is important.

28. On fresh air intake replace screens that have grids smaller than half inch square, which obstructs the fresh air flow.

29. Check and calibrate thermostats semi-annually.

30. Relocate any room thermostats that are in positions where they can be affected by the sun, cold walls, or factors other than room temperature.

Domestic Water Systems

1. Consider the installation of a direct fired domestic water heater, rather than using a heating boiler.

2. Insulate all hot water lines.

3. Establish flow controls on water systems wherever possible.

4. If showers are being used in your schools, consider reducing shower head capacities.

5. Arrange for a system that will turn off direct hot water recirculation pumps manually or by time clock.

6. Consider installing spring shut-off devices on hot water faucets, or even all faucets.

7. Reduce hot water temperature to 43 degrees Celsius.

8. Maintain water temperatures at 82 degrees Celsius for commercial dishwashing machines used in your school. Booster heaters are usually a good buy for this purpose.

9. Limit hot water for general use to 43 degrees Celsius. If water is hotter, the user will normally add cold water to cool it.

10. Turn gas water heaters down to 24 degrees Celsius when closing kitchen; turn back up two hours before opening.

11. Shut off hot water circulating systems during non-school hours.

12. Ensure all hot water pipes, storage tanks are insulated and that insulation is checked on a regular basis.

13. Install flow restrictor showerheads in all shower facilities.

14. In washrooms, use flow restrictors on all faucets or install new "spray" taps that use far less water than ordinary faucets.

15. If renovating, consider installing self-closing faucets, especially on hot water lines.

16. Upgrade toilet and urinal flush valves by retrofitting with more water efficient valves.

17. Install timers or measuring devices to control flushing cycles on urinals.

18. Reduce water usage in standard toilet tanks through the use of "dams" or more efficient ballcock mechanisms. Bricks in the tank are not recommended as they tend to crumble and may cause problems.

[R86/1450R]

19. In new installations, specify "water-saver" type toilets that use only about three gallons per flush rather than the usual five gallons or more.

20. Have water tested for hardness. In some cases, a water conditioner can provide significant benefits, such as lessening of scale buildup in hot water tanks.

21. Place appropriate conservation stickers in every bathroom - the mirror is a good place.

22. Consider your fuel options and your efficiency of conversion - will you save by changing or converting?

23. Repair leaks in water piping system.

24. Repair or replace leaky faucets, toilets, pump glands and valves.

25. Clean and recondition hot water temperature mixing valves at least annually.

26. Check insulation on hot water pumps and storage tanks frequently.

27. Flush hot water tanks every six months or more frequently if water is very hard, to remove solids and sludge which have settled in bottom of tanks.

28. Remove exterior scale buildup from electric hot water heater coils at least annually. With immersion type hot water heaters installed in the boiler shell, remove and clean scale buildup from interior and exterior coil surfaces.

29. Check the temperature controls on water storage tanks every six months.

30. Test hot water controls and adjust if necessary.

31. Check the steam trap on steam hot water heaters. If steam is passing through the trap, repair or replace as necessary.

LIGHTING AND OTHER POWER REQUIREMENTS

Lighting is not free. The pennies per day for each lamp add up. In total the lamps in a school can add up to 15% of its total energy costs.

LIGHTING AND OTHER POWER REQUIREMENTS

1. When deciding on light levels, check with the people working in each area. Light requirements vary with age and physical condition. Learning will suffer if light is not adequate.

2. Have you considered installing more light switches where possible to allow for more light control?

3. If necessary, have switches moved so they are convenient and visible. People are more apt to co-operate in energy conservation programs if it is easy.

4. In areas that don't always require full lighting, have additional switches installed so that only those lights being used need to be turned on.

5. If you have a large number of lighting fixtures in a school, have you considered the possibility of changing all lighting - where possible - from incandescent to fluorescent lighting? New 7,9 and 13 watt screw-in fluorescents can replace 25, 40 and 60 watt incandescent lamps and last ten times as long.

6. Establish a regular cleaning schedule for lighting fixtures (dirty fixtures can reduce lighting levels 25% to 40%).

7. Have you provided for regular checks on levels of illumination? (Some suggested levels are listed at the conclusion of this section).

8. Install twist-on or door jamb switches for lights in such areas as storerooms, closets, and walk-in coolers, where staff could leave lights on by mistake.

9. Use stickers on light switches to remind staff and students to "switch-off" when leaving a room.

10. Institute the following preventive maintenance schedule: check automatic lighting controls daily; clean windows and skylights every three months or as required; clean fixtures and lamps every six months or as required; clean ceilings and walls annually or as required.

11. Where fluorescent lighting is already in use, consider the use of lower wattage "watt-saver" or "watt miser" fluorescent tubes. These tubes use less energy with only a minor reduction in light output. For example, 35-watt tubes can replace 40-watt tubes; or 60-watt ones can replace 75-watt tubes.

12. Reduce decorative lighting as much as possible. In clustered fixtures, consider removing some lamps, or simply use lamps of a lower wattage - lamp rates as low as one-watt are available for some fixtures.

[R86/1450R]

13. When replacing ballasts for fluorescent tubes, choose those with the best (highest) power factor rating.

14. Replace reflector floor lights with parabolic lights. They will use about half the energy and give you a comparable amount of light.

15. When replacing fixtures, purchase the most energy efficient system which is appropriate.

16. When redecorating, use light colours on walls and ceilings to reflect light - especially in work areas such as kitchens, shops, labs, libraries and maintenance rooms.

17. In room with high ceilings, install suspended lamps to bring the source closer to the area being lighted.

18. In classrooms, provide flexibility by installing recessed fixtures or adjustable track lighting.

19. If removing unnecessary lamps, take them from behind work areas rather than in front. Front lighting keeps the area free of shadows.

20. Always follow manufacturer's instructions when removing some lamps from a multi-lamp fixture. In most four-bulb fluorescent, for example, two lamps must be removed to prevent ballast problems. Disconnect or remove the ballast if possible, since it will continue to consume energy.

21. Check automatic lighting controls daily, and adjust for season light variation.

22. Establish a regular schedule of cleaning fixtures and lamps at least semi-annually. When cleaning and/or relamping fluorescent fixtures, the following steps should be taken: remove and clean louvres or plastic diffuser, replace if yellowed; remove lamps and clean, set aside if being replaced; install socket covers and shock protection; clean top and outside fixture, clean inside of fixture; remove socket covers (to free for relamping); install lamps; install louvres or plastic diffuser; and allow lamps to "drip dry", wiping could cause a static charge which might interfere with starting-up.

23. Mark each fixture with plastic tape indicating proper wattage lamp to be used.

24. Turn off lights in unoccupied mechanical equipment rooms, shops, storage rooms and other spaces where lights are not essential for safety or security, but ensure exit lights and hazard lights always meet safety and fire codes.

25. Consider installing load stabilizers to lower peak power demands.

26. Arrange to have portable classroom power distribution on one meter for all portables to minimize demand billing.

[R86/1450R]

27. Consider the balancing of electrical phases.

28. If outdoor car plugs are in use in any of your school parking lots, have them operable only when temperatures drop below -10 degrees Celsius.

29. If outdoor car plugs are in use in any of your school parking lots, consider a policy of prohibiting the use of interior car heaters.

30. Have power turned off in portable classrooms in summer months.

31. Arrange for parking lot and security lights to be placed on a separate time clock that is adjustable.

32. Arrange for fewer, but higher intensity discharge lights for parking lots and security areas (i.e. high pressure sodium).

33. Investigate the use of efficient high pressure sodium (HPS) lamps for outdoor areas such as parking lots.

34. Control outdoor lighting by automatic timer switches or photo cells, remembering that timer switches must be seasonally ajdusted.

35. Bear in mind that dark buildings are less reflective and will need more light than light buildings.

36. Ensure that there isn't too great a contrast between outdoor light level and entranceway and exists. Sharp differences betwen glare and darkness can create a safety hazard.

RECOMMENDED LIGHTING LEVELS

Auditoriums	32	decalux *
Cafeterias (Dining)	32	"
Cafeterias (Kitchen)	74	"
Classrooms	75	"
Corridors	22	"
Reading Areas	75	"
Art and Music Areas	75	"
Typing Areas	75	"
Home Economics (Sewing)	107	"
Home Economics (Classroom)	75	"
Home Economics (Cooking)	75	"
Laboratory (Class)	75	"
Laboratory (Precision areas)	107	"
First Aid (General)	75	"
First Aid (Examination)	107	"
Gymnasium (General)	32	"
Gymnasium (Change/Exercise)	27	"
Library (Reading Area)	75	"
Library (Stacking Area)	53	"
Lounges	27	"
Offices (General Areas)	75	"
Offices (Fine Work Areas)	107	"
Offices (Circulation Areas)	43	"
Storeroom (Active Areas)	21	"
Storeroom (Inactive Areas)	5	"
Washrooms	32	"
Parking Areas	3	"

* decalux = .929030 foot candles
= 10 lumens per square metre.

[R86/1450R]

LAMP SUBSTITUTION GUIDE

This chart gives you examples of savings achievable by substituting lamps or, in some cases, retrofitting for lamp substitution. Lamp manufacturers can provide you with more comprehensive lists of possible substitutions.

Now Using	Change to	Illumination Provided	Watts Saved	Power Savings Per Lamp*
40 watt fluorescent	34 watt fluorescent	approx. same	6	$ 2.25
25 watt incandescent	PL-7 fluorescent	up to 40% more	18	9.00
40 watt incandescent	34 watt incandescent	approx. same	6	.30
	PL-9 fluorescent	up to 24% more	31	15.50
60 watt incandescent	PL-13 fluorescent	slightly less	47	23.50
75 watt incandescent	27 watt screw fluorescent	slightly less	48	18.80
75 watt par 38	55 watt par 38	approx. same	20	3.00
75 watt R30 Flood	50 watt ellipsoidal reflector	same or more	25	2.50
100 watt incandescent	90 watt incandescent	approx. same	10	1.75
	75 watt reflector	up to 25% more	25	6.25
	60 watt reflector	same or more	40	12.00
	40 watt screw-in fluorescent	approx. same	56	21.00
150 watt R-40 Flood	100 watt par 38 Flood	up to 133% more	50	12.50
	90 watt ellipsoidal reflector	up to 56% more	60	15.00
(R) 250 watt mercury	215 watt high pressure sodium	up to 130% more	35	21.00
(R) 400 watt mercury	325 watt metal haldide	up to 40% more	70	52.50
(R) 1000 watt mercury	880 watt high pressure sodium	up to 440% more	120	72.50

* savings based on 5¢ per KWH over rated lamp life
(R) indicates retrofit

The following two charts provide data for lamps and for ballasts which supplement the information given above. The costs shown were those in effect on Prince Edward Island in March, 1987.

[R86/1450R]

Richardson Associates Ltd.
18-Mar-87

LAMP DATA

Type	Watts	Initial Lumens	Mean Lumens	Lumen Depreciation			Mean Lumens /Watt	Colour Rendition			Average Lamp Life	Lamp Cost	Labour Cost	Total Re-lamping Cost
				+	0	-		+	0	-	(hrs)	$ ea	$ ea	$ ea
Incandescent	25	270	270	+			10.8	+			1,000	.79	5.00	5.79
	40	460	460	+			11.5	+			1,000	.66	5.00	5.66
	60	870	870	+			14.5	+			1,000	.61	5.00	5.61
	100	1,560	1,560	+			15.6	+			1,000	.61	5.00	5.61
	200	3,545	3,545	+			17.7	+			1,000	1.87	5.00	6.87
R	150	1,900	1,900	+			12.7	+			2,000	4.13	5.00	9.13
PAR	150	1,730	1,730	+			11.5	+			2,000	6.33	5.00	11.33
ER	75	900	900	+			12.0	+			2,000	7.15	5.00	12.15
ER	120	1,700	1,700	+			14.2	+			2,000	8.14	5.00	13.14
Mercury Vapour	100	2,450	1,950			-	19.5		0		24,000	81.40	10.00	91.40
	250	13,000	10,700			-	42.8			-	24,000	19.09	10.00	29.09
	400	23,000	19,100			-	47.8			-	24,000	21.45	10.00	31.45
	1000	60,000	45,000			-	45.0			-	16,000	121.83	10.00	131.83
Fluorescent														
PL-7	7	400	380	+			54.3		0		10,000	10.29	5.00	15.29
PL-9	9	600	570	+			63.3		0		10,000	10.29	5.00	15.29
PL-13	13	900	855	+			65.8		0		10,000	10.29	5.00	15.29
F40 CW	40	3,200	2,890	+			72.3		0		20,000	1.93	10.00	11.93
F40/CW/EE	34	2,925	2,575	+			75.7		0		20,000	2.64	10.00	12.64
F032 CW Octron	32	2,900	2,550	+			79.7		0		20,000	6.82	10.00	16.82
F96/T12/CW	75	6,300	5,985	+			79.8		0		12,000	5.94	10.00	15.94
F96/T12/CW/EE	60	5,850	5,750	+			95.8		0		12,000	6.38	10.00	16.38
Metal Halide	175	14,000	10,200		0		58.3		0		7,500	47.14	10.00	57.14
	250	20,500	16,000		0		64.0		0		10,000	50.05	10.00	60.05
	400	34,000	24,600		0		61.5		0		20,000	53.02	10.00	63.02
	1000	110,000	83,000		0		83.0		0		12,000	112.20	10.00	122.20
High Pressure Sodium														
	50	3,800	3,420		0		68.4			-	24,000	91.85	10.00	101.85
	70	5,860	5,270		0		75.3			-	24,000	44.33	10.00	54.33
	100	8,800	7,920		0		79.2			-	24,000	44.33	10.00	54.33
	250	26,000	23,400		0		93.6			-	24,000	56.10	10.00	66.10
	400	47,500	42,750		0		106.9			-	24,000	57.20	10.00	67.20
	1000	140,000	126,000		0		126.0			-	24,000	150.70	10.00	160.70
Low Pressure Sodium														
	18	1,800	1,800	+			100.0			-	14,000	45.38	10.00	55.38
	35	4,800	4,800	+			137.1			-	18,000	45.38	10.00	55.38
	55	8,000	8,000	+			145.5			-	18,000	45.38	10.00	55.38
	90	13,500	13,500	+			150.0			-	18,000	60.50	10.00	70.50
	135	22,500	22,500	+			166.7			-	18,000	75.90	10.00	85.90
	180	33,000	33,000	+			183.3			-	18,000	90.75	10.00	100.75

Richardson Associates Ltd.
19-Mar-87

BALLAST DATA

			NORMAL BALLASTS					EE BALLASTS					ELECTRONIC BALLASTS				
TYPE	**Lamp Watts**	**Labour Cost ($ ea)**	**Watts/Ballast**	**Lamp(s) & Ballast Watts**	**Ballast Cost ($ ea)**	**Installed Cost ($ ea)**	**Ballast Life (Years)**	**Watts/Ballast**	**Lamp(s) & Ballast Watts**	**Ballast Cost ($ ea)**	**Installed Cost ($ ea)**	**Ballast Life (Years)**	**Watts/Ballast**	**Lamp(s) & Ballast Watts**	**Ballast Cost ($ ea)**	**Installed Cost ($ ea)**	**Ballast Life (Years)**
Mercury-Vapour	100	35	22	122	33.00	68.00	10										
	250	35	35	285	52.80	87.80	10										
	400	35	50	450	58.30	93.30	10										
	1000	35	65	1065	99.00	134.00	10										
Fluorescent																	
PL-7	7	5	3	10	15.40	20.40	10										
PL-9	9	5	3	12	15.40	20.40	10										
PL-13	13	5	3	16	15.40	20.40	10										
F40 CW	40	35	16	96	16.50	51.50	10	6	86	19.80	54.80	20-25	4	84	54.50	89.50	20+
F40/CW/EE	34	35	16	84	16.50	51.50	10	4	72	19.80	54.80	20-25	4	72	54.50	89.50	20+
F032 CW Octron	32	35	n/a	n/a	n/a	n/a	n/a	2	66	29.70	64.70	20-25	4	68	67.70	102.70	20+
F96/T12/CW	75	35	33	183	24.20	59.20	10	16	166	28.60	63.60	20-25	8 est	158	62.20	97.20	20+
F96/T12/CW/EE	60	35	33	153	24.20	59.20	10	16	136	28.60	63.60	20-25	8 est	128	62.20	97.20	20+
Metal Halide	175	35	35	210	49.50	84.50	10										
	250	35	30	280	52.80	87.80	10										
	400	35	55	455	66.00	101.00	10										
	1000	35	70	1070	96.80	131.80	10										
High Pressure Sodium																	
	50	35	10	60	33.00	68.00	10										
	70	35	18	88	82.50	117.50	10										
	100	35	30	130	88.00	123.00	10										
	250	35	60	310	96.80	131.80	10										
	400	35	65	465	99.00	134.00	10										
	1000	35	70	1070	104.50	139.50	10										
Low Pressure Sodium																	
	18	35	16	34	16.50	51.50	10										
	35	35	24	59	82.50	117.50	10										
	55	35	24	79	82.50	117.50	10										
	90	35	35	125	89.10	124.10	10										
	135	35	43	178	101.20	136.20	10										
	180	35	44	224	101.20	136.20	10										

CAFETERIAS AND KITCHENS

The majority of schools have no cafeteria. However, many of the tips given in this section apply just as much to the kitchen in your own home. When a school does have a cafeteria, a significant proportion of its energy costs originate there.

CAFETERIAS/KITCHENS

General

1. Follow manufacturer's suggestions. Determine a schedule of pre-heating times for ovens, grills, broilers, fryers, and other cooking equipment. Post prominently by each unit.

2. Cook the largest volume possible. Most food service establishments find they can prepare some items more efficiently by cooking them partially or completely in volume and freezing them until needed.

3. If you have a large cafeteria you could consider the purchase of a blast freezer so you can freeze large volumes of food. This will save production time, operating time of equipment, and labour.

4. Group grills, ovens and warmers as close together as possible, and as far as practical from refrigerators and freezers.

5. Investigate the possibility of installing side walls on existing exhaust hoods. Codes generally allow for lower exhause rates from cubicles than from hoods.

6. Size exhaust fans to meet minimum code requirements. Many exhaust systems are greatly oversized and remove far more conditioned air from the building than is necessary.

7. Schedule cleaning of walls and ceilings on a regular basis.

8. Schedule all cleaning during daylight hours to save on heating and lighting.

9. Reduce the dishwasher temperature to the minimum allowed by health regulations.

10. Position hot water boosters within five feet of dishwasher and insulate pipes to avoid heat loss. Shut off when not needed.

11. Fence griddles on three sides to reflect heat onto food.

12. Consider installation of automatic shut-offs for: variable speed hood exhaust systems; dishwashers (to shut off 1-2 minutes after last rack); intermittent exhaust fans, such as used over dishwashers (to shut off 2-3 minutes after dishwasher shuts off).

13. Install twist-on timer switches for lights in storerooms.

14. Develop a lamping plan that gives required illumination at specific work stations: 80-100 foot-candles in work areas; 50 foot-candles or less are adequate for storage areas.

[R86/1450R]

15. Co-ordinate deliveries to eliminate unnecessary openings of freezers and refrigeration units.

16. Install solenoids on garbage disposal units for automatic cut-off of water and electricity.

17. Consider installing plastic strip freezer doors to reduce heat gain.

18. Break the habit of turning everything on first thing every morning. Unless you plan to use a piece of equipment, leave it off until it's needed. Turn on fans and appliances only when required; turn off when not in use.

19. Review all cooking methods with a view to energy conservation.

20. Cook at the lowest temperature that gives satisfactory results. Slow cooking retards meat shrinkage and retains nutrients and better colour in all foods. Slow cooking also means lower energy consumption; even though lower temperatures result in longer cooking times, the savings on energy losses from cooking equipment to the surrounding air are great enough to make low-temperature cooking more energy efficient.

21. Cover pots and pans to keep heated air in and decrease cooking time.

22. Stagger start-up times of equipment to avoid heavy electrical demand at one time.

23. Immediately following rush periods, turn off all but one of each type of equipment - for instance, one burner instead of two, and one fryer instead of three. Lower the temperatures of idling equipment if possible.

24. Set thermostats on all cooking equipment to the lowest temperature that will still give satisfactory results, consistent with safe food handling practices.

25. Use warming tables wisely. They are not cooking appliances. You can waste energy and dry out foods with excessive heat. Learn the recommended serving temperatures of different types of foods.

26. Turn on food warmers and hot plates only as needed, turn them off when not in use. Run at the lowest temperature possible for safe food handling.

27. Do not allow fans to blow directly onto any cooking equipment or surface.

28. Thaw frozen food in the refrigerator (this reduces the refrigerator's demand for electricity). Large volumes of food can be thawed on racks in steamers. Thaw all foods before cooking unless prohibited by product characteristics (as with french fries and pies). Thawed foods require one third less time to cook.

[R86/1450R]

29. Cook with as little water as possible.

30. Use cold water when it will do the job.

31. Don't leave faucets running.

32. Fill sinks for pot washing rather than keeping the water running - the same for cleaning vegetables.

33. Use hot tap water, rather than water heated on range-top, for cooking when possible.

34. Turn off rotary toasters when not in use and clean regularly. Clean equipment performs more efficiently and uses less energy.

[R86/1450R]

CAFETERIAS/KITCHENS

Fryers

1. Drain fryers daily.

2. Fryers need to be cleaned and the oil filtered at least once a day.

3. Do not load fryer beyond manufacturer's stated capacity.

4. Turn off fryer or reduce to idling temperature and cover during slack periods.

5. Turn thermostat only as high as necessary to reach frying temperatures. In modern, high-speed fryers, temperatures ranging from 165°C to 177°C are ideal. (Too high a temperature also causes the oil to break down.)

6. Preheat only as long as manufacturer's instructions recommend.

7. Turn on the gas fryer no more than 20 minutes before use.

8. Use fryer instead of the range top for frying, but don't turn on two fryers when one will do.

9. Use a second fryer only for peak periods.

10. Remove water or ice from product before frying to eliminate oil breakdown and temperature fluctuation.

11. Clean heating elements at least once a week, and daily if used for high volume frying. Remove any burnt food or grease that would interfere with efficient operation.

12. Lubricate gas valves.

14. Inspect flue for proper draft and remove any obstructions.

15. Adjust and clean pilot light.

16. Inspect safety pilot and solenoid.

17. Adjust and clean gas burners.

18. Inspect oil container for grease leaks.

19. Inspect and clean interiors of fixed-well fryers for grease or carbon deposits.

20. Clean grease and food particles from exhaust hoods. Clean filters regularly.

[R86/1450R]

CAFETERIAS/KITCHENS

Griddles

1. Whenever possible, huddle food on griddle close together and heat only the portion of griddle being used.

2. Heat griddle only to temperature required for food being cooked. A low or medium flame is best for griddling.

3. Never overheat a griddle in the interest of speed. The cooking results could be disastrous and it is wasteful.

4. During slack periods, turn the burner on your griddle down, and turn off some sections.

5. Scrape excess food and fat particles from the surface with a flexible spatula, grill brick or other device after each cooking load.

6. Clean and wipe out the grease troughs, remove any stuck-on food, and clean the surface with a soft cloth, rubbing with the grain of the metal while the surface is still warm. This should be done at least once a day, and more often if the cooking load is heavy.

7. Have utility company service representatives periodically check air/gas mixture on gas griddles and adjust pilot light to lowest possible flame.

8. Check surface temperature against control dial reading. Recalibrate thermostat if necessary.

[R86/1450R]

CAFETERIAS/KITCHENS

Broilers

1. Preheat no longer than manufacturer's instructions recommend.

2. Monitor preheat times with thermostats or timers.

3. Load heated broilers to capacity when practical to utilize the entire surface area.

4. Heat only as many sections as required by the cooking load.

5. Turn the broiler flame to low between broiling operations and off completely during slow periods.

6. When possible, use infrared broilers, which can be turned off when not in use and quickly reheated, rather than idling less efficient equipment.

7. Lubricate valves.

8. Check flue for proper draft and remove any obstructions.

9. Periodically call in a qualified utility company service representative to check air shutters to make sure air/gas mixture is correct.

10. Check and clean burner orifices on gas broilers.

11. Have a service representative check gas burners every six months.

12. Rearrange the ceramic material in under-fired broilers once a month to assure even heat. Replace blackened or cracked chips.

CAFETERIAS/KITCHENS

Ovens

1. Cook food while oven is warming. Begin the day's baking or roasting with foods that require the lowest oven temperature.

2. Load oven to capacity, but maintain a 2-inch clearance in standard ovens for proper air circulation. Less clearance is required in forced-air convection ovens.

3. Determine the cooking capacity of ovens. Use the smallest or most efficient one available.

4. Use second oven only when cooking schedules overlap unavoidably.

5. Load and unload ovens quickly, and don't open the door during operation. Every second the oven door is open, the temperature drops about 10°. Food cooks faster and loses less moisture if the oven door is kept closed.

6. Clean interior oven walls and elements to achieve better heat transfer.

7. Vacuum crumbs from oven burners each week.

8. Keep lower edge of door free of food particles so door will seal properly.

9. Keep microwave oven interior clean of spills and food particles. Never clean with abrasives which may damage oven surface and reduce efficiency.

10. Check gas pressure monthly to ensure correct pressure for complete combustion.

11. Every few months, have a qualified service representative calibrate thermostats, inspect burners, door closing and insulation. Have service representative adjust air/gas mixture at least annually, and adjust pilot light to lowest possible flame.

12. Adjust door hinges, gaskets, and moldings for a tight fit.

13. Adjust ovens and oven racks so that they are level.

14. Check the flue for proper draft and remove any obstructions.

15. Use a proper exhaust canopy which uses the correct mixture of exhaust and make-up air.

[R86/1450R]

16. Position ovens properly under exhaust canopies.

17. Have a service representative check microwave ovens for radiation leaks regularly. Have safety interlock, magnetron and timer checked annually.

18. Clean fan blades on convection ovens according to manufacturer's instructions. Dirt restricts the amount of air delivered. Have motor checked annually.

[R86/1450R]

CAFETERIAS/KITCHENS

Ranges

1. Use the shiny side of aluminum foil under burners to reflect wasted heat, improve efficiency, and facilitate cleaning. Guard against blocking air inlets.

2. There's no need to preheat an open top range, 10 to 15 minutes is all that's necessary for a solid-top range.

3. Cover pots and pans when possible to reduce cooking time.

4. Use black or dull finished pots since they absorb heat better than shiny pots.

5. Use a pot or pan that is one inch larger than the burner on an electric range.

6. Save gas by grouping pots and pans on solid range tops and lighting only those burners needed.

7. Use flat bottom utensils on solid top ranges. Nearly any type of pot or pan can be used on an open top gas range, because the flame will tailor itself to the shape of the pan.

8. When using a gas range for full heat conditions, the tip of the flame should just touch the bottom of the pan or kettle.

9. Lower heat to simmer as soon as liquids begin to boil. Remember that water and water-based liquids boil at 100°C. Turning the heat higher does not cook food any faster: it only uses more energy.

10. Cook at the lowest temperature that will still give satisfactory results.

11. Turn off range when it isn't needed.

12. Check gas burners periodically. If the flame is yellow or uneven, clean the burner with a wire brush and make sure holes are clear. If trouble persists, have service representative adjust gas/air mixture.

13. Adjust and clean pilot lights.

14. Inspect automatic burner lighters and safety controls.

15. Check thermostats for accuracy and calibrate if necessary.

16. To clean burners and coils on open top ranges, remove encrusted matter from cool heating elements, then soak them in water and a good grease solvent. Burners should be boiled in a solution of salt or washing soda, or detergent.

[R86/1450R]

17. With closed top ranges, lift or remove the hood periodically to be certain burners are functioning properly.

18. To clean closed top ranges, rub vigorously with heavy burlap or a wire brush after the top surface has cooled somewhat. Remove any cooked food lodged under burners, lid rings, or plates.

19. Schedule routine inspections.

20. Contact utility representative if the unit is not functioning properly.

CAFETERIAS/KITCHENS

Steam Cooking

1. Fill cooking vessels according to manufacturer's recommendations, and to capacity, if possible. The amount of steam used is almost the same whether cooking a large or small amount of food.

2. Turn off the steam unless actually cooking. Pre-heat times are short so the equipment should not be kept running.

3. Use steam cookers for shorter cooking times.

4. Use a steamer to begin cooking food whenever possible. Then finish cooking in the conventional manner.

5. Thaw frozen food in steam vessels rather than in boiling water. Racks of frozen food may be thawed in volume, but food should be spaced to allow steam to circulate around each item, and once thawed should be immediately cooked through.

6. Clouds of steam indicate unnecessarily high temperatures. Dial temperature down to reduce both the amount of energy required to operate the steam table and the load on your heating/ventilating/air conditioning system.

7. Establish a firm schedule for cleaning steam cooking equipment. Follow the manufacturer's instructions, and use a non-toxic cleaner.

8. Flush boilers at least weekly, following manufacturer's instructions. Use a commercial cleaning chemical occasionally, especially if your water is hard.

9. Remove all deposits such as rust, lime, film and scale, from the water jacket and outside of container.

10. Repair all steam leaks, no matter how small.

11. Inspect all steam traps for steam leakage.

12. Keep all seals clean and tight to prevent steam leakage to kitchen.

13. Inspect the insulation on steam lines for damage. Light-gauge sheet metal may be used to protect insulation where steam lines are exposed to damage. If damaged, replace insulation promptly.

14. Regularly check thermostats for accuracy, and calibrate if necessary.

[R86/1450R]

CAFETERIAS/KITCHENS

Dishwashers

1. Do not use dishwasher until a full load is available. The same amount of energy is used whether or not racks are full.

2. When main dishwashing rush is over, turn off booster heaters and accumulate dishes until next rush period.

3. Turn water heater down to 24°C when kitchen closes, and turn back up two hours (or warm-up time required by your particular unit) before opening.

4. Check rinse water regularly for excessive temperature.

5. Check that the power rinse is turning off automatically when the tray goes through the machine.

6. Use a wetting agent instead of a power dryer.

7. Consult the owner's manual for proper maintenance instructions.

8. Check insulation of water line in recirculation loop.

9. If there is no automatic fill with shut-off, provide squeeze type valve to avoid wasting water by overfilling.

10. Inspect the feed and drain valves and pumps weekly for water leakage.

11. Remove lime deposits from spray nozzles. Nozzles should be reamed with a wire when white deposits become visible at the openings.

12. Remove lime deposits from tanks and heater coils.

13. Lubricate speed reducer on conveyor-type washers regularly.

14. Ensure that the power rinse turns off automatically.

15. Set flow controls for proper amount of rinse water.

16. Adjust power dryer to deliver heated air just long enough to barely dry dishes.

17. Drain and flush hot water heater at least every six months.

18. Check accuracy of thermometer and recalibrate if necessary.

19. Make regular checks of rinse water to avoid excessive temperatures.

20. Install pressure-reducing valves to control water pressure for rinsing.

[R86/1450R]

CAFETERIAS/KITCHENS

Refrigerators and Freezers

1. Thaw frozen foods in refrigerator whenever possible. As food thaws, the surrounding air is cooled, reducing the refrigerator's energy demand.

2. Do not place hot food in a cooling unit. Allow it to cool (in accordance with safe food handling practices) before refrigerating or freezing.

3. Plan ahead so that when a worker enters a walk-in unit, or opens refrigerators or freezers he or she can obtain or replace several items at one time. Frequent and lengthy door openings waste energy.

4. Use trays or mobile racks to reduce the time refrigerators and freezer doors need to be opened.

5. Place frequently used items at front of unit to reduce length of time doors are open.

6. Clearly label stored items; tape a diagram showing location of items to door of refrigerator or freezer.

7. Turn off lights when leaving walk-in coolers. Lights produce unwanted heat as well as wasting electricity. Units should have signal light switches to warn if lights are left on.

8. Close doors immediately after items have been removed or replaced.

9. Do not place items in front of refrigerator coils in a manner that will restrict air flow.

10. Be sure items do not jam against closing doors, which could damage door gaskets and cause leaks.

11. Defrost freezers frequently; ice buildup should not exceed 1/8" on walls and shelves.

12. Consolidate food where possible to reduce the numbers of refrigerators and freezers in use. Full units use energy more efficiently than partially full ones.

13. Schedule food deliveries where possible to avoid overloading or underusing refrigeration facilities. Store food requiring refrigeration or freezing promptly. Recooling such foods not only wastes energy, but may also affect the quality of items.

14. Do not store anything within four feet of the refrigeration compressor.

15. Cover all liquids stored in the refrigerator. Moisture is drawn into the air from uncovered liquid, raising the temperature of air inside the refrigerator.

16. Maintain proper tension on refrigerator compressor belts and replace any that are worn or damaged.

17. Inspect and service all electric motors, fans and compressors on a regular basis.

18. Keep all door gaskets, seals and hinges in good condition. Try the dollar bill test. Close the door on a bill. If it falls to the floor, the gasket needs replacing.

19. Lubricate latches and hinges with food grade oil.

20. Check thermostats for proper calibration.

21. Feel the outside walls of refrigerators and freezers for cold spots. Any cold areas indicate insulation failure.

22. Check compressor for leaks and level of refrigerant.

23. Check refrigerators for loss of temperature control and short cycling problems. If the unit is not operating properly, check the refrigerant level.

24. Keep refrigerator blower coil free of ice buildup, dirt, dust and grease.

25. Brush clean the condenser.

26. Have a service representative adjust the freezer defrost cycle so it will defrost during off peak hours.

27. Level units periodically. Doors should fit correctly and close automatically from an open position.

Kitchens and cafeterias are major consumers of energy. Given co-operation by your staff, and a little effort, they can be areas where a considerable amount of energy can be saved.

SCHOOL GROUNDS

It may seem that school grounds are not a significant factor in energy management. However, if appropriate, the following suggestions may produce meaningful energy savings.

SCHOOL GROUNDS

1. Install timers to control hours of operation of outdoor lighting and illuminated signs.

2. Locate parking lots on the cool side of the building. Glass and metal of cars reflect sunlight on to building.

3. Plant grass all around the building if possible.

4. Plant shrubs, deciduous trees and climbing vines where appropriate.

5. Consult a landscape architect to assist you with energy conservation ideas.

6. Investigate the possibility of having some walls banked with earth.

7. Keep anything that might obstruct free air flow away from the outside of room air conditioners.

8. Keep all equipment in top operating condition. Poorly maintained equipment does not operate efficiently.

TRANSPORTATON

Where a school has a maintenance section, or contracts its transportation needs to private entrepreneurs, the following suggestions should be part of the maintenance program and included in instructions to drivers. The suggestions are listed for situations where school transportation needs do not warrant outside contracts or fully-fledged departments.

TRANSPORTATION

1. Impress upon drivers how important low fuel consumption is. Consider an award to the driver getting the best mileage.

2. Investigate the possibility of converting some vehicles to propane or compressed natural gas. (See EMR about a grant of up to $400 per vehicle converted to propane, and $500 per vehicle converted to compressed natural gas - CNG.)

3. A diesel engine requires less maintenance, gets better mileage and lasts longer than a gasoline engine.

4. Specify radial tires when ordering new vehicles. Gas mileage will be improved about five per cent over bias ply tires.

5. Don't allow the engine to idle for long periods of time.

6. Fill gas tank slightly less than full to avoid overflow.

7. Report any malfunctions immediately, such as a pulling to the side or a sudden reduction in gas mileage.

8. Keep tires inflated to correct pressure.

9. Replace carburetor air cleaner and oil filter as necessary.

10. As a regular part of a maintenance program it is suggested that you: check that the choke is operating properly, (a slow-acting or stuck choke wastes fuel); clean, check and gap spark plugs; check ignition timing; clean distributor cap, adjust or replace condensors and points; check and adjust wheel alignment; and each spring and fall do a thorough inspection and complete tune-up.

AN ENERGY MANAGEMENT PROGRAM FOR YOU

Given commitment, the planning, organizing and running of an energy management program calls for no more and no less than the good sense possessed by everyone in a position of responsibility: knowing how to benefit from the expertise of others in areas where one is weak; understanding that a dollar spent on energy is a dollar no longer available for anything else; and realizing that one must accept the responsibility for doing something about it.

SETTING UP AND RUNNING AN EFFECTIVE ENERGY MANAGEMENT PROGRAM

Energy management is the application of sound business techniques to energy use. These are basically the same techniques as are applied to finance and administration in order to keep the school board as a viable entity. Using these techniques effectively to reduce waste will free up money for other parts of the school board administration by keeping energy consumption and costs at a controlled minimum. Potential savings exist even in well-run schools, but it takes effort to realize them.

Energy management is first and foremost a management and organizational effort. Without proper attention to organization, an energy management program will be only marginally successful, or will fail.

Energy management depends on people - the more people involved, the more effective the program. Their involvement, however, must be structured and planned. Regardless of the size or type of organization, the following four elements are essential to any successful energy management program:

- commitment of senior administration;
- promotion of energy conservation to become second nature;
- defined realistic goals; and
- program planning and implementation.

Senior Administrative Commitment

The full support of senior administrative personnel and their enthusiastic participation must be clearly expressed and visibly demonstrated not only at the outset but also for the duration of the program.

As a first step, tell principals and maintenance supervisors why effective energy management is needed and what their related responsibilities are. If the school board has a collective agreement, discuss the plan of action with union officials for teaching and non-teaching staff and obtain their support. Then launch the program with a strong policy statement by the Chairman or Director of Education and follow it up immediately by a presentation to employees explaining the need for efficient energy use. The regional office of Energy, Mines and Resources, Canada may be able to help with such a presentation.

Without ongoing senior administrative commitment, an energy management program is doomed to failure. Also, employees will apply their best efforts to the program only if they see the same kind of commitment by those in top administrative positions.

[R86/1450R]

Program Responsibility

In small school boards make board staff responsible for reducing energy consumption as part of their management duties. In larger school boards, appoint an energy program committee, headed by a co-ordinator who will be fully responsible for carrying out the program and accountable for the result. Give the co-ordinator orientation training and have him or her report to senior management. In most cases, the program will be effective only to the degree the co-ordinator is allowed to spend time and effort on it. Make sure adequate funds are available to operate the program effectively, as well as incentive awards for those who have caused significant savings in energy costs.

The committee should have members from each major energy-using department, particularly representation from building maintenance. Members should be prepared to conduct investigations and studies and to make recommendations affecting their areas. Energy resource management yields the best results when its importance is raised to a level where it becomes second nature.

Defining Realistic Program Goals

The co-ordinator should brief the committee fully on all available information about energy use, challenging the members to explore ways of conserving energy in their respective areas or departments.

Set energy savings goals at the start to provide a program target. Establish a system of reporting progress toward these goals. Review the goals periodically as your information about energy use becomes more accurate. Goals should be realistic, specific, and measurable, and should offer enough incentive that employees are challenged to achieve them.

Set realistic goals by applying standards which indicate how much energy should be used for a particular application. Measure current performance against calculated practical or theoretical energy requirements. Always set goals and standards in familiar energy units such as BTU, therms, KWH, etc.

Program Implementation

The first technical step in an energy management program is the energy audit made from a series of surveys. It shows where and how energy is being used and/or wasted.

Begin by reviewing the oil and utility bills. Obtain data for at least a one-year period to establish a 12-month revolving base period upon which estimates and performance comparisons ccan be made without seasonal distortions.

Audit energy use on a departmental basis, and also on individual systems and equipment. Basic energy use data on equipment is usually obtainable from the nameplate on each unit.

[R86/1450R]

An ideal audit lists each type of energy usage, the minimum practical or theoretical energy required for each, the actual energy used and the variance between the minimum and actual use. The goal is to reduce the variance to a minimum by identifying wasteful practices which can be corrected. The audit also identifies areas requiring further analysis, and pinpoints places where on-line energy flow measurement is needed and can be justified economically. One rule of thumb suggests that metering should be installed when the annual cost of energy exceeds five times the cost of the meter.

In the first physical plan survey, identify wasteful operations and develop a checklist covering the normal housekeeping functions plus such items as leaking utility lines, damaged insulation, equipment that is permitted to idle when it could be turned off, or other examples of improper operation or maintenance. Survey energy use during non-working hours.

Energy can be measured in any unit compatible with the way it is purchased and should be correlated as required to an equivalent unit for all energy sources. BTU or gigajoule (GJ) is recommended as a common denominator.

A thorough energy audit is to good energy management what a thorough financial audit is to good financial management. It serves essentially the same purpose. Without an energy audit it is difficult to find out how to conserve energy, how to measure the success of an energy management program.

Energy audits can often be done by in-house personnel. If this is not possible, a qualified consultant may help the co-ordinator and his committee identify where energy management can be improved and energy saved. The government provides assistance towards the cost of feasibility studies by consultants. Investigate this assistance, and also the free energy audits conducted by competent engineers under the energy bus program. This confidential service also provides tangible evidence of a school boards's energy management program.

Program Implementation and Continuing Energy Management Efforts

Correct the obvious wastes found in the initial survey immediately, and record the corrective action. You can eliminate most of these wastes by procedural changes requiring little capital investment, and resulting in savings of 10 to 20 per cent in the first year.

Start your program with modest but quickly obtainable savings. Obvious targets are classroom and office lighting, heating and cooling. The measurable savings you achieve in these areas will encourage the energy management committee to seek greater savings in the less obvious areas of energy use. A short-term target of 5 per cent savings during the first six months of an energy management program is generally acceptable. Too long a lead time, with a correspondingly higher target, may cause loss of enthusiasm.

[R86/1450R]

Analyze the energy surveys to reveal which energy services show the most potential for immediate improvement. Make a cost-benefit analysis based on future energy costs to reveal the merit of each potential improvement project and help you to set priorities. Implement selected projects as soon as approved.

Record energy used by the entire school, every operating department, and each significant area. Do this regularly on a monthly or quarterly basis. The record will highlight unfavourable trends which should be explained and corrected as soon as possible.

Have the energy management co-orinator hold regular meetings with his committee to review progress and update project lists. Previously set goals will require evaluation and new goals should be established as necessary. Have the committee conduct a continuing program of energy management activities and communication to maintain employee interest. The co-ordinator should also make periodic progress reports to management and use these as an opportunity to review the program and re-establish continuing support for it.

Every school board which has an energy management program in place should consider seriously the formation of voluntary Energy Conservation Task Force in its area. Non-proprietary energy information can be shared with other participants, and information on energy management programs and conservation techniques exchanged through seminars, workshops, Task Force newsletters and other appropriate means. For more information about Task Forces, contact the Canadian School Trustees' Association or the nearest regional office of Energy, Mines and Resources Canada. (See page 2 and 3)

Summary

The management of energy means achieving the most productive use of energy relative to its cost. A well designed and properly run energy management program will mean that more money is available for the education process by keeping energy consumption and costs at a controlled minimum. The crucial elements of a successful program are:

- active support of senior administrative personnel to meet clearly defined goals;
- the establishment of ways to monitor and evaluate progress; and
- implement corrective action by involving employees at all levels.

Successful programs are those which start with modest but quickly obtainable savings, usually by improving housekeeping functions within the school.

[R86/1450R]

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[R86/1450R]